## Nits Separator

The invention relates to a plant for producing a nonwoven fibre web out of a fibrous material and consists of a defibrator, such as a hammer mill, for forming the fibre web on a endless forming wire which, when in operation, mostly runs horizontally, an initial transport fan which transports defibrated fibres via an initial duct to a forming head, and a second transport fan which extracts nits from the forming head.

Nits are knots which occur in the defibrated fibrous material as a result either of incomplete defibration in the defibrator, during transport to the forming head or during the processes which take place within the forming head.

Nits impair the quality of the finished fibre product. Conventionally, the nits are removed by extracting them from strategic locations within the forming head and returning the extracted material to the hammer mill where the nits are separated into separate fibres and then returned to the forming head.

Achieving a sufficiently high quality finished fibre product presupposes that all the nits are extracted. However, this requires such an efficient extraction that extraction of a significant amount of well-defibrated fibres is inevitable. This means that, in practice, by far the greatest part of the extracted material consists of well-defibrated fibres.

To ensure that the nits are entirely removed, the total quantity of extracted fibre material is large and the defibrator is thus subjected to significant extra load.

The extra load, which may account for up to 50% of total power consumption, thus significantly reduces the defibrator's useful capacity to defibrate new fibre material.

The defibrator is often a bottleneck in any given plant and, where this is the case, the above-mentioned reduction in the useful capacity of the defibrator prevents 100% utilisation of the remainder of the plant. The total operating costs are increased correspondingly.

The large quantity of re-circulated fibre material in itself causes great wear and tear on the defibrator. Furthermore, practical experience has shown that the fibre material does not flow evenly across the whole width of, for example, a hammer mill but tends rather to concentrate in certain areas around the rotor, gradually wearing traces in the rotor which must then be repaired.

A second disadvantage connected to the above-mentioned conventional method for removing nits from the forming head and re-grinding them in the defibrator is that large quantities of well-defibrated fibre travelling through the process alongside the nits are shortened to some degree during the defibration process, thus diminishing the quality of the finished fibre product.

The air streams which transport fibre material around the plant form a unified system, which is difficult to control.

As mentioned above, the fibrous material containing nits extracted from the forming head is transported back to the defibrator where it is defibrated along with new material. At the end of this process, the extracted material is transported back to the forming head on the same jet of air as the new fibre material. This jet of air is constantly supplied with fresh air sucked into the defibrator, which works therefore under negative pressure. At the same time, air is sucked out of the forming head via the forming wire.

The system concerned is therefore an interconnected system in which extraction from the forming head can easily be disrupted by changes to the hammer mill parameters. This is due to the fact that the partial vacuum in the hammer mill changes correspondingly. A change to these operative parameters demands a great deal of adjustment in order to ensure that the plant functions optimally at all times.

The primary purpose of the invention is to design a plant as described in the introductory paragraphs which can function with a lower energy consumption than previous types of plants.

A second purpose of the invention is to design a plant as described in the introductory paragraphs which can better produce a high quality product without nits and shortened fibres.

A third purpose of the invention is to design a plant as described in the introductory paragraphs which is easier to control than any previous type of plants.

A fourth purpose of the invention is to design a plant as described in the introductory paragraphs which ensures that the load on the defibrator is more even, that the defibrator is subjected to less wear and tear and that its capacity is utilised more efficiently than ever before.

What is new and characteristic of the invention and ensures that these improvements are achieved is that the plant consists of a separator connected to the second duct to separate the nits from the well-defibrated fibres.

This design ensures that the large quantities of nits and defibrated fibres extracted from the forming head are channelled past the defibrator which can then be utilised exclusively for defibration of new material. This saves the

energy used by conventional plants to treat the extracted material in the defibrator. Furthermore, the defibrator is allowed to work with a constant, even load and is not subject to the kind of wear and tear to which, for example, a hammer mill rotor has hitherto been subjected.

As at least some of the well-defibrated fibres are conveyed past the defibrator and do not come into contact with the airborne stream of defibrated fibrous material in it, the jets of air in the plant are more easily controlled, avoiding the disadvantages associated with adjusting conventional plants.

One further advantage is that the finished fibre product achieves optimum high quality, firstly because the fibres are not shortened by the defibrator and, secondly, because all the nits are sucked up without causing load on the defibrator with the large quantities of defibrated fibres which are extracted along with the nits when a complete nit extraction is sought.

The separated, defibrated fibres may be collected in a suitable way for later use. However, this material can with advantage be returned to the forming head by means of a third transport fan and a third air duct.

Furthermore, the separated nits can be removed from the nits separator by means of a fourth transport fan inserted in a fourth air duct, which in one type of construction can be connected to the defibrator.

As the separated nits account only for a minor part of the fibrous material sucked away from the forming head, the advantages achieved by using a plant of the kind described in accordance with the invention can partly be maintained even if the separated nits are transported directly to the defibrator for defribration there.

In one suitable type of construction the plant may include a separate nits defibrator, the purpose of which is to turn the separated nits into well-defibrated fibres. The advantage inherent in this construction is that the defibrator is not subject to the strain of the separated nits.

In this case, the fourth air duct may run between the nits separator and the nits defibrator, which may also be connected to the forming head via a fifth air duct with a fifth transport fan which returns the defibrated nits to the forming head, so that, following defribration in the nits defibrator, the separated nits are channelled in a circuit avoiding the defibrator.

The nits defibrator and the nits separator can both be constructed in any suitable way. The nits defibrator may, for example, be a hammer mill or, alternatively, a refiner to defibrate the nits either between two grinding discs or on a card. The nits separator may be a forming head, a cyclone or an air separator.

The invention is described in more detail below, referring to a single drawing which shows only one plant construction in accordance with the invention as an example.

The plant includes a number of transport fans. These are drawn with dotted lines to indicate that one or several of these transport fans may be omitted in special variations of the construction shown.

The main components of the plant in the illustrated construction are an existing hammer mill 1, an existing forming head 2, an existing forming wire 3 (mounted underneath the forming head), a nits separator 4 and a nits defibrator 5.

Fibre material, which in this example is assumed to be cellulose pulp, is fed to the hammer mill 1 on a roller 6. The pulp is defibrated into single fibres in the hammer mill in the usual way by means of a rotor 7 (rotates during operation) with hinged hammers 8.

By means of the first transport fan 9 and via the first duct 10, the fibres are channelled to the forming head 2 on a jet of air, formed when the hammer mill is supplied with air via an air intake 11.

The forming head 2 shown comprises principally a housing 12 with a perforated base 13 and a number of rotors 14 with wings 15 mounted above the base.

The forming wire 3 comprises an endless, air permeable belt which runs over a number of idle rolls 16 (there are four in the example shown) and a driving roll 17. A suction box 18 is mounted underneath the forming wire with a fan 19 to create a partial vacuum in the suction box.

During operation, the fibres supplied to the forming head 2 over the perforated base 15 are distributed by means of the wings 15 on rotating rotors 14.

The partial vacuum in the suction box 18 generates a stream of air across the base and forming wire 2. This stream of air gradually pulls the fibres down onto the forming wire via the openings in the perforated base.

The forming wire will normally consist of a grid whose mesh size ensures that the majority of the fibres form a web 20 on the upper side of the forming wire while the air streams past into the suction box 18.

The forming wire transports the web of fibres further along in the direction indicated by the arrow for treatment in the later stages of the process in the plant (not shown).

Nits are knots in the defibrated fibre material, formed in the hammer mill during transport to the forming head and during the process which takes place there. The nits diminish the quality of the finished fibre product and are therefore removed from the forming head in the normal way via a second air duct 21 via a second transport fan 22.

A high quality finished fibre product contains no nits at all, which is why the nits must be removed completely from the forming head before they reach the point at which they are swept along by the jet of air through the base of the forming head.

A strong jet of air is needed for efficient extraction of the nits. This strong jet of air will unavoidably also suck away large quantities of well-defibrated fibres at the same time. In practice, significantly more well-defibrated fibre is sucked up through the second air duct 21 than nits.

The nits and the well-defibrated fibres are channelled via the second air duct 21 to the nits separator 4. This separator may, for example, be a small forming head (not shown) which can easily be adjusted for this specific purpose.
It is an advantage if the extraction beneath the forming head is just strong enough to ensure that the nits are separated with an optimum concentration of nits in the extracted material. Strong suction may mean that there is a small quantity of nits in the mass of separated well-defibrated fibres. This is, however, not crucial as the nits are again caught in the forming head and subsequently once more subjected to the separation process in the nits separator.

Alternatively, the nits separator may, however, be a cyclone (not shown) or a air separator (not shown).

The separated, well-defibrated fibres are removed from the nits separator by means of a third transport fan 23 and are returned to the forming head via a third air duct 24 without being shortened or otherwise damaged (as they would be in a conventional plant).

The separated nits are extracted from the nits separator by means of a fourth transport fan 25 via a fourth air duct 26, connected to the nits defibrator 5. The nits defibrator may, for example, be a small hammer mill (not shown) or a refiner (not shown) to defibrate the nits between two grinding discs or on a card (not shown).

Having been defibrated in the nits defibrator , the now well-defibrated fibres are channelled back to the forming head 2 via a fifth air duct 27 by means of a fifth transport fan 29. In the drawing the third and fifth air ducts 24;27 are joined at their connection to the forming head. These two air ducts 24;27 may alternatively be separately connected to the forming head (not shown).

One air duct 28 is drawn with dotted lines to indicate that the hammer mill 1 may be used to defibrate the nits instead of the nits defibrator 5, which is then superfluous. This solution may be advantageous in cases where there is excess capacity in the hammer mill, as the level of required investment is correspondingly reduced.

The above description and drawing of the invention are based on a plant which comprises one hammer mill 1, one forming head 2, one forming wire 3, one nits separator 4 and one nits defibrator 5.

However, within the scope of this invention's patent protection, the plant may have any suitable number of the above-mentioned components nos. 1, 2, 3, 4 and 5 and in any combination.

The defibrator does not necessarily have to be a hammer mill but may equally well be any other kind of suitable defibrator.

Furthermore, the plant can be constructed to pre-treat not only cellulose fibre but also other fibrous materials or a mixture of these.